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10/774,603	02/10/2004	Eric R. Fossum	M4065.1025/P1025	1683

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WASHINGTON, DC 20006

EXAMINER
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HERNANDEZ, NELSON D

ART UNIT	PAPER NUMBER
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2622

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/774,603	<b>Applicant(s)</b> FOSSUM, ERIC R.	
	<b>Examiner</b> Nelson D. Hernández	<b>Art Unit</b> 2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication; even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 10 February 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 26-56 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 26-56 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/10/2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>8/9/2004</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. **Claims 26-40, 44-52 and 54-56 are rejected under 35 U.S.C. 102(a) as being anticipated by Denyer et al., WO 97/20434.**

**Regarding claim 26**, Denyer et al. discloses an imager (See figs. 3 and 4), comprising: a semiconductor substrate (by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22); an array of photosensitive sites (fig. 3 shows an array of pixels 2) located on the substrate, the array including a plurality of first photosensitive sites (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32), wherein each first photosensitive site is configured to measure the level of a first spectral component (i.e. green light) in light received by the respective first photosensitive site, and a plurality of second photosensitive sites (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32); a line decoder (16 and 18 as shown in fig. 3) formed on the substrate and having at least one serial output for transferring out at least one line of measured spectral components from the array during

a read out operation (page 11, line 1 - page 12, line 25); and an interpolator (Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25) located in the substrate (Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22) and configured to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites in the at least one line transferred out during the read operation (Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22).

**Regarding claim 27**, limitations can be found in claim 26.

**Regarding claim 28**, each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second photosensitive site (taking in consideration green as a first spectral component for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring red, green and blue colors as discussed in claim 26 above), and the interpolator is further configured to estimate the level of the second spectral component in the light received by at least one of the first photosensitive sites based on at least one measurement of the second spectral component obtained respectively by at

least one of the second photosensitive sites in the at least one line transferred out during the read operation (Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Denyer et al. inherently teaches that to interpolate the color for a position where a second color is measured, colors representative of said first color (i.e. green) are used to perform color interpolation in order to form synchronous, parallel color channel signals for the video signal before being output to a display unit) (Fig. 4: 30); page 11, line 33 – page 12, line 25).

**Regarding claim 29**, limitations can be found in claims 26 and 28 above.

**Regarding claim 30**, a plurality of third photosensitive sites (i.e. measuring blue) (Denyer et al. discloses measuring red, green and blue colors as discussed in claim 26 above), and the interpolator is further configured to estimate the level of the first spectral component in the light received by at least one of the third photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites in the at least one line transferred out during the read operation, and to estimate the level of the second spectral component in the light received by at least one of the third photosensitive sites based on at least one measurement of the second spectral component obtained respectively by at least one of the second photosensitive sites in the at least one line transferred out during the read operation (As discussed in claim 28, (Denyer et al. inherently teaches that to interpolate the color for a position where a third color is measured, colors representative of said

first color (i.e. green) are used to perform color interpolation to obtain the values of the first color, and colors representative of said second color (i.e. red) are used to perform color interpolation to obtain the values of the second color in order to form synchronous, parallel color channel signals for the video signal before being output to a display unit) (Fig. 4: 30); page 11, line 33 – page 12, line 25)).

**Regarding claim 31**, limitations have been discussed in claims 28 and 30 above.

**Regarding claim 32**, limitations can be found in claims 26, 28 and 30 above.

**Regarding claim 33**, Denyer et al. discloses an A/D conversion element (fig. 4: 26) located in the substrate (Denyer et al. discloses that the A/D converter can be incorporated in the same chip where the imaging array is located; page 13, lines 1-22; page 12, lines 20-25) and configured to receive the at least one line of measured spectral components read out from the line decoder and output the received measurements as digital values to the interpolator (page 11, line 33 – page 12, line 25), and wherein the interpolator estimates the first spectral component levels in the second and third photosensitive sites, the second spectral component levels in the first and third photosensitive sites, and the third spectral component level in the first and second photosensitive sites based on the digital values received from the A/D conversion element (page 11, line 33 – page 12, line 25).

**Regarding claim 34**, limitations have been discussed in claim 33 above.

**Regarding claim 35**, Denyer et al. discloses that the at least one serial output of the line decoder (Figs. 3: 16 and 3: 18; see also figs. 6: 45, wherein a read out means

may comprise a plurality of shift registers) transfers out several sequential lines of measured spectral components from the array during each read out operation (Page 14, line 33 - page 15, line 27; using a plurality of shift registers would result in outputting a plurality of rows or an image block that would result in speeding up the readout process).

**Regarding claim 36**, limitations can be found in claim 35 above.

**Regarding claim 37**, Denyer et al. discloses an imager (See figs. 3 and 4), comprising: a semiconductor substrate (by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22); a plurality of first photosensitive sites (fig. 3 shows an array of pixels 2) located in the substrate, wherein each first photosensitive site is configured to measure the level of a first spectral component in light received by the respective first photosensitive site (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32); a plurality of second photosensitive sites located in the substrate (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32); and an interpolator (Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25) located in the substrate (Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22) and configured to receive

digital data (output from an A/D converter 26 as shown in fig. 4; page 11, line 33 – page 13, line 23) representing the spectral component levels measured in the photosensitivity sites, and to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one digitized measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22).

**Regarding claim 38**, limitations can be found in claim 28 above.

**Regarding claim 39**, limitations can be found in claims 28, 30 and 33 above.

**Regarding claim 40**, limitations can be found in claim 32 above.

**Regarding claim 44**, Denyer et al. discloses an imaging device (See figs. 3 and 4), comprising: a display (Fig. 4: 30) for displaying an image on an array of M x N pixels (page 11, line 33 – page 12, line 25); and an imager (Fig. 3: 1 and 4: 1) which comprises a substrate (by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22), an M x N array of photosensitive sites located on the substrate (fig. 3 shows an M x N array of pixels 2), the array including a plurality of first photosensitive sites located in the substrate (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32), wherein each first photosensitive site is configured to measure the level of a first color (i.e. green) component in light received by the respective first photosensitive site, and a plurality of second



photosensitive sites (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32) located in the substrate, wherein each second photosensitive site is configured to measure the level of a second color component in light received by the respective second photosensitive site (taking in consideration green as a first spectral component for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring red, green and blue colors as discussed in claim 26 above); and an interpolator (Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25) located in the substrate (Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22) and configured to receive digitized color component values corresponding to the measurements obtained in the first and second photosensitive sites, to estimate the level of the first color component in the light received by at least one of the second photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the first photosensitive sites, and to estimate the level of the second color component in the light received by at least one of the first photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the second photosensitive sites (Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22).

**Regarding claim 45**, limitations can be found in claim 28 above.

**Regarding claim 46**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 47**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 48**, limitations can be found in claim 28 above.

**Regarding claim 49**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 50**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 51**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 52**, Denyer et al. discloses an imaging device (See figs. 3 and 4), comprising: a display (Fig. 4: 30) for displaying an image on an array of  $M \times N$  pixels (page 11, line 33 – page 12, line 25); and an imager (Fig. 3: 1 and 4: 1) which comprises a substrate (by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22), an  $M \times N$  array of photosensitive sites (fig. 3 shows an  $M \times N$  array of pixels 2) located on the substrate, the array including a plurality of first photosensitive sites located in the substrate (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32), wherein each first photosensitive site is configured to measure the level of a first color component (i.e. green) in light received by the respective first photosensitive site, a plurality of second photosensitive sites located in the substrate (the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32), wherein each second photosensitive site is configured to measure the level of a second color component in light received by the respective second photosensitive site

(taking in consideration green as a first spectral component for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring red, green and blue colors as discussed in claim 26 above), a plurality of third photosensitive sites (i.e. measuring blue color), wherein each third photosensitive site is configured to measure the level of a third color component in light (i.e. blue) received by the respective third photosensitive site; and an interpolator (Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25) located in the substrate (Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22) and configured to determine, for each of the  $M \times N$  photosensitive sites, digitized color component values for the color components not measured in the respective photosensitive site, and to output digitized color component values for the first, second and third color components for each of the  $M \times N$  photosensitive sites (Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22).

**Regarding claim 54** limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 55**, limitations can be found in claims 28, 30 and 35 above.

**Regarding claim 56** limitations can be found in claims 28, 30 and 35 above.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 41 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denyer et al., WO 97/20434 in view of Acharya, US Patent 6,091,851.**

Regarding claim 41, Denyer et al. does not explicitly disclose that the interpolator output twenty four bits of color data for each photosensitive site, with each color value being represented by eight bits.

However, Acharya teaches the concept of performing color recovery of imager captured by a camera (Fig. 3: 330) using a single sensor having a Bayer pattern color filter array in order to obtain a full resolution image from an object (Fig. 3: 340) being photographed, wherein the individual color components of each pixel area represented by eight bits (in order to represent a color intensity range from 0-255) and the pixels of the image after interpolation is performed would have a total resolution of twenty four bits (Col. 1, lines 4-48; col. 2, lines 40-52; col. 3, lines 16-41; col. 5, line 26 – col. 6, line 26; col. 9, lines 1-8). Acharya also discloses that the interpolation method can be performed by hardware and firmware and that the interpolation method can be performed by the camera processor (Fig. 3: 32) (Col. 10, lines 7-17).

Therefore, taking the combined teaching of Denyer et al. in view of Acharya as a whole, one of an ordinary skill in the art, after appreciating the advantages of the

interpolation method of Acharya, would find obvious at the time the invention was made to modify the imager of Denyer by having the interpolator output twenty four bits of color data for each photosensitive site, with each color value being represented by eight bits. The motivation to do so would have been to have a desirable amount of color intensity values (256 color intensity values) for each color of each pixel in the image and to better represent luminance in recovering missing color components to have the output image to better resemble the original color of the object prior to its image capture.

**Regarding claim 53**, limitations can be found in claim 41 above.

**5. Claims 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denyer et al., WO 97/20434 in view of Okada, US Patent 6,133,953.**

**Regarding claims 42 and 43**, Denyer et al. does not explicitly disclose that the interpolator includes at least one serial register for storing digital bit values representing the spectral component measurements from a photosensitive site being interpolated and the photosensitive sites neighboring the photosensitive site being interpolated.

However, Okada teaches a camera (Fig. 1) having a single imaging element (Fig. 1: 10) having a color separation circuit (Fig. 1: 100) having a two dimensional register (Figs. 1: 30 and 3: 30) connected to an interpolation processing circuit (Figs. 1: 34 and 4: 34), said two dimensional register receiving the digitized color values by an A/D converter (Fig. 1: 48) stored in a frame memory in order to input the color values from a block surrounding a particular pixel position where a color value is calculated by interpolation (as shown in fig. 3, the registers (302, 304, 306, 308, 310, 312, 314, 316,

318, and 320) receive serially the color values of the pixels in a block as shown in fig. 2A; col. 7, line 16 – col. 8, line 38). Okada also discloses that to interpolate the color values for a pixel position, said interpolation digitally weights the values of the color being calculated using the color values stored in the two dimensional register (having plural serial registers storing the colors values for four lines in a block) based on the distance from the color values used for interpolation to the position of the pixel to have the colors calculated (Col. 5, line 65 – col. 6, line 19; col. 6, lines 51-65; col. 7, line 16 – col. 8, line 38; col. 8, lines 59-65).

Therefore, taking the combined teaching of Denyer et al. in view of Okada as a whole, after appreciating the advantages of having serial registers storing the color values for of pixels to be used for estimating the color value of a particular pixel as taught in Okada, one of an ordinary skill in the art would find obvious at the time the invention was made to modify the imager in Denyer et al. to have the interpolator including at least one serial register for storing digital bit values representing the spectral component measurements from a photosensitive site being interpolated and the photosensitive sites neighboring the photosensitive site being interpolated and to estimate a spectral component level for a photosensitive site, the interpolator digitally weights the values of the spectral component being estimated, as measured by the photosensitive sites providing the measurements and which are currently stored in the at least one serial register, based on the distances of the photosensitive sites providing the measurements from the photosensitive site for which the spectral component is being estimated. The motivation to do so would have been to improve the interpolation

processing in the imager by serially storing the color values in the registers so that said color values can be access in a parallel by the interpolation circuit thus receiving the values needed for calculation at the same time and to accurately calculate the missing colors based on the particular position of the colors used for interpolation thus better representing the colors and have the output image to better resemble the original color of the object prior to its image capture.

### ***Contact***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nelson D. Hernández whose telephone number is (571) 272-7311. The examiner can normally be reached on 9:30 A.M. to 6:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on (571) 272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number:  
10/774,603  
Art Unit: 2622

Page 15

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Nelson D. Hernández  
Examiner  
Art Unit 2622

NDHH  
January 5, 2008



LIN YE  
SUPERVISORY PATENT EXAMINER